

**Measuring the Change in Hardness of Pure Metals During
Annealing** M. G. Loshakov and N. G. Fokina *Acta Metall.*
USSR-U.S.S.R. 1984 (Table 1, 2)

An apparatus for measuring the change in hardness of pure metals during annealing is described. The apparatus consists of a hardness tester, a temperature control system, and a data recording system. The apparatus is used to measure the change in hardness of pure metals during annealing at various temperatures and times. The results of the measurements are shown in Table 1 and Table 2.

It is shown that the hardness of pure metals decreases rapidly with time at a constant temperature. The decrease in hardness is more pronounced at higher temperatures. The decrease in hardness is also more pronounced for metals with higher initial hardness. The results of the measurements are shown in Table 1 and Table 2.

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USSR

Deformation characteristics of single crystal and polycrystalline copper during high speed vacuum casting

single-crystal Cu specimens were studied in a vacuum rod 15 mm diam. and 65 mm long obtained in the air of the molten metal

oriented close to the slip plane of the single crystal the grain

low temperature

strongly deformed

5/

FEDOTOV, S.G.

Making cores without use of lanterns. Proisv.--tekhn.inform.
no.9:60-62 '54. (MIRA 10:3)
(Foundry machinery and supplies)

USSR/Physics-Carbon steel, hardness

FD-1224

Card 1/1 Pub. 153-8/22

Author : Lozinskiy, M. G. and Fedotov, S. G.

Title : Effect of carbon content on hardness of carbon steels at high temperatures

Periodical : Zhur. tekhn. fiz. 24, 1609-1612, Sep. 1954

Abstract : Tests were carried out by the authors in order to study the effect of carbon content in ordinary carbon steels on laws governing the variation of hardness in the range from room temperature to 800°. The applied methods are described. These are considered less expensive and less troublesome than those usually employed. Nineteen references including 2 foreign.

Institution :

Submitted : February 25, 1954

USSR/Engineering - Metallography

FEDOTOV, S.G.,

FD-2241

Card 1/1 Pub 41-9/17

Author : Osipov, K. A. and Fedotov, S. G., Moscow

Title : The heat content and mechanical properties of metals

Periodical : Izv. AN SSSR, Otd. Tekh. Nauk 2, 98-104, Feb 1955

Abstract : Cites experimental data on the relationship between the heat content and the mechanical properties of various metals. Diagrams, tables. Thirty references, 10 USSR

Institution: Institute of Metallurgy imeni A. A. Baykov and Institute of Machine Science, Academy of Sciences USSR

Submitted : November 22, 1954

Podolov, S. G.

3694 Microstructure and Hardness Variation of Some Precious Metals During Vacuum Heating, M. G. Lazinski and S. G. Podolov, Henry Dunster Foundation No. 3564, 1 p.

100-113 Henry Dunster Foundation No. 3564, 1 p. Hardness of the Pt group metals and their alloys studied up to 1350 C.

of

~~LOZINSKIY, M.G. FEDOTOV, S.G.~~
Category : USSR/Solid State Physics - Mechanical properties of crystals and poly-crystalline compounds E-9

Abs Jour : Ref Zhur - Fizika, No 1, 1957, No 1351

Author : Lozinskiy, M.G., Fedotov, S.G.

Title : On the Correlation Between the Compression Hardness and the Modulus of Normal Elasticity of Pure Metals at Higher Temperatures

Orig Pub : Izv. AN SSSR, Otd. tekhn. n., 1956, No 3, 59-67

Abstract : An investigation was made of the connection between the hardness of the metal as an index of resistance to plastic deformation, and the modulus of normal elasticity, as a characteristic of the elastic properties of the metal. The hardness was measured with thirteen pure metals heated to 1100° or to the melting temperature, using a vacuum setup constructed by the author. The values of E were calculated from the natural transverse oscillations at resonant frequency. The results were compared for 20, 500, and 800°. The result was that the data for most metals, when plotted in H_v -E coordinates, give a clearly pronounced linear relationship between the measured characteristics. Exceptions are W, Mo, Ti, Zr and Co, which display a sharp loss of strength upon a slight rise in temperature. At 800°,

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Category : USSR/Solid State Physics - Mechanical properties of crystals and poly- E-9
crystalline compounds

Abs Jour : Ref Zhur - Fizika, No 1, 1957 No 1351

deviations from linearity are observed for metals in which viscous flow occurs along the grain boundaries when the hardness is measured. The authors believe that the principal role in the resistance to plastic deformation at increased temperatures is played by the strength of the inter-atomic bonds, characterized by the modulus of elasticity.

Card : 2/2

SOV/180-59-3-30/43

AUTHORS: Mikheyev, V.S. and Fedotov, S.G. (Moscow)

TITLE: Hardness of Titanium Alloys at Elevated Temperatures

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1959, Nr 3, pp 145-148(USSR)

ABSTRACT: Results of hardness tests are given for 6-component titanium alloys with aluminium content of 0.5 to 12%. Specimens were prepared in a vacuum arc furnace and hardness measurements taken using a diamond indenter which was loaded for one minute. The temperature was varied from 20 to 1000°C. Hardness results are given in the table. The first figures in each case are for the as cast alloys and the second for alloys quenched from 1150°C. Fig 1 and 2 show the influence of temperature on hardness. Small additions of Cr, Fe, Si and B increase the hardness and with increasing Al addition from 0.5 to 12%, the hardness is further increased. At room temperature the hardness is lower for the as cast alloy but at 300 to 500°C the quenched alloy is harder due to ageing processes. Above 500°C there is a sharp decrease in the quenched alloy. It is not clear why the hardness of the quenched alloy is less

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SOV/180-59-3-30/43

Hardness of Titanium Alloys at Elevated Temperatures

than that of the cast alloy. At 1000°C the alloy containing 12% Al is five times harder than that of the alloy containing 0.5% Al. There are 2 figures, 1 table and 3 Soviet references.

ASSOCIATION: Institut metallurgii AN SSSR (Metallurgical Institute, Academy of Sciences, USSR)

SUBMITTED: April 4, 1959

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18.1285

67809

AUTHORS: Mikheyev, V.S., and Fedotov, S.G. (Moscow) SOV/180-59-5-26/37

TITLE: Influence of Aluminium on the Modulus of Normal Elasticity of Titanium Alloys at Elevated Temperatures

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1959, Nr 5, pp 141-142 (USSR)

ABSTRACT: The authors have studied the influence of a variable aluminium content on the modulus of normal elasticity of six-constituent titanium alloys at elevated temperatures. The quaternary α -titanium solid solutions with chromium, iron, silicon and boron (Ref 1) were taken as basis alloys. PKhMZ TG-0 titanium was used for the preparation of alloys. This contained the following weight percentages of impurities: Fe - 0.02, Si, C, Ni, Cl, N₂ - 0.03 each, Mg - 0.04, O₂ - 0.09, and H₂ - 0.003. The basic mechanical properties of titanium were: $\sigma = 40 \pm 45$ kg/mm², $\delta = 30$ to 40%, $\psi = 60 \pm 70\%$, $\sigma_k = 19 \pm 29$ kg/cm², and $H_b = 130 \pm 140$ kg/mm². Cast ingots of 1 to 2 kg in weight were forged into rods of 14-16 mm diameter at a temperature of 1100 to 1150 °C. The alloys were melted in a vacuum arc furnace with consumable electrodes. The modulus of normal elasticity

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was determined by a radiotechnical method by means of measuring the frequency of natural oscillations during excitement of transverse oscillations in the specimen. The specimens were in the form of cylindrical rods, 200 mm long and 10 mm in diameter. Heating of the specimens which were suspended by thin nichrome wires from the container and exciter, was effected in a special tri-sectional electric furnace. The apparatus and method of measurement have been described by Lozinskiy et al (Refs 2, 3). The modulus of normal elasticity for a cylindrical specimen can be calculated by the formula

$$E = 1.6388 \cdot 10^{-8} (\ell/d)^4 G / \ell^2 \text{ kg/mm},$$

where ℓ is the length of the specimen in cm, d is the specimen diameter in cm, G is the weight of the specimen in g, and f is the frequency of natural oscillations in Hertz. (Abstractor's note: it appears that one of the ℓ 's in the above formula should be ' f '). The figure on p 142 shows curves for the change of the modulus of normal elasticity on heating of titanium, the titanium alloys

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T-3, T-4, T-6 and T-8 and their bases representing a solid solution of α -titanium with chromium, iron, silicon and boron. From the above data it follows that small soluble additions of chromium, iron, silicon and boron raise the modulus of normal elasticity of titanium both at room temperature and at elevated temperatures. A noticeable increase of this property is observed when aluminium is introduced in the alloy in addition. The higher the aluminium content of the alloy, the higher its modulus of normal elasticity. It is also noted that when titanium is alloyed with aluminium the intensity of drop of the modulus of elasticity of titanium alloys on heating decreases noticeably with increase of aluminium content. In the study of the long-term strength, creep and hardness of these alloys at elevated temperatures, it has also been found by Kornilov et al (Ref 1) that the strength properties of titanium alloys and their resistance to creep increase with increase in aluminium content. The authors express gratitude to M.G. Lozinskiy for the facilities offered ✓

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67809

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Influence of Aluminium on the Modulus of Normal Elasticity of
Titanium Alloys at Elevated Temperatures

to them to carry out experiments in the measurement of
the modulus of normal elasticity.

There are 1 figure and 3 Soviet references.

ASSOCIATION: Institut metallurgii AN SSSR
(Institute of Metallurgy, Ac.Sc. USSR)

SUBMITTED: April 4, 1959

Card 4/4

18.8200
18.1285

48 (6)

AUTHORS:

Fedotov, S. G., Mikheyev, V. S.

66167

SOV/20-128-5-19/67

TITLE:

On the Interrelation Between Indentation Hardness and Modulus of Normal Elasticity in Titanium Alloys at High Temperatures

PERIODICAL:

Doklady Akademii nauk SSSR, 1959, Vol 128, Nr 5, pp 933-936 (USSR)

ABSTRACT:

As early as 1913 N. S. Kurnakov et al (Refs 2, 3) investigated the pressure occurring during the flowing out of plastic bodies and the character of changes in hardness of copper-nickel alloys as a function of composition. He came to the conclusion that the Brunell hardness of the solid solutions depends directly on the product of the modulus of elasticity and the relaxation time: $H_B = ET$, where H_B denotes the Brunell hardness, E the modulus of elasticity, and T the relaxation time. Thus, the change in hardness of such alloys may be due either to a change in the modulus of elasticity, or to a change in relaxation time, or to a simultaneous change in both quantities. P. P. Lazarev (Ref 4) also pointed out a close interrelation between these properties of metals. In the present paper results of measurement of the indentation hardness and the normal modulus of elasticity of titanium,

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On the Interrelation Between Indentation Hardness and SOV/20-128-5-19/67
Modulus of Normal Elasticity in Titanium Alloys at High Temperatures

a five-component solution of α -titanium with chromium, iron, silicon, and boron, and of a six-component solution of titanium with an additional variable aluminum content. The aluminum content amounted to 3.0, 4.5, 6.0, and 7.5% by weight. The alloys were fused in an arc furnace. The preparation of the samples is discussed in brief. The results obtained by the measurement of hardness at temperatures varying from room temperature to 1000°C are given in a diagram. The next diagram shows the curves for the variation of the normal modulus of elasticity of titanium, which forms the basis of the above alloys. Simultaneous addition of slight amounts of chromium, iron, silicon, and boron increases the hardness and the modulus of normal elasticity of titanium. An increase in the values for these quantities at room temperature and higher temperatures is also produced by a further admixture of aluminum. However, the rate of increase is not the same for both quantities, especially at room temperature. Experimental data found by the authors reveal that the consolidation of the titanium alloys at room temperature (in relation to their aluminum content) is mainly due to structural factors of ✓

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On the Interrelation Between Indentation Hardness and SOV/20-128-5-19/67
Modulus of Normal Elasticity in Titanium Alloys at High Temperatures

consolidation, or to an increase in relaxation time together with an increase in interatomic interaction. The indentation hardness and the modulus of normal elasticity decrease on heating. On investigating titanium and its six-component alloys with variable aluminum content the authors drew the following conclusions, among others: (1) Soluble admixtures of chromium, iron, silicon, and boron increase the hardness and the modulus of normal elasticity of a solid solution of α -titanium. (2) Aluminum is the element which produces the most marked consolidation of titanium alloys at room temperature and higher temperatures. (3) The high solidity of titanium alloys with varying aluminum content is preserved in the temperature interval between room temperature and 500-600°C, and decreases rapidly at higher temperatures. (4) The relation between the characteristic properties of the resistivity of the alloys to plastic deformation and of the interatomic interaction becomes increasingly marked with rising experimental temperatures. There are 4 figures, 1 table, and 6 Soviet references.

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Inst. Metallurgy in A. A. Baykov AS USSR

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S/180/62/000/004/009/009
E040/E435

AUTHOR: Fedotov, S.G.

TITLE: Second Seminar on the Theoretical and Experimental
Investigations of Titanium Alloys

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye
tekhnicheskikh nauk. Metallurgiya i toplivo,
no.4, 1962, 189-191

TEXT: The Seminar was held on March 9-12, 1962 at the Institut metallurgii imeni A.A.Baykova (Institute of Metallurgy imeni A.A.Baykov). Some 30 papers were presented in which the results were given of investigations concerning chemical reactions of titanium with the more important elements, studies of phase equilibrium diagrams of poly-component titanium systems, development of new techniques for the forging and welding of titanium alloys, development of high-strength, high-plasticity titanium alloys for service at extreme temperature conditions etc. Each of the papers read at the Seminar is briefly annotated. Discussion of the papers was followed by adopting the following resolution and recommendations: To extend the investigation of
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Second Seminar on the Theoretical ... S/180/62/000/004/009/009
E040/E435

chemical reactions of titanium with other elements and especially to publicize the results of investigation of the metallo-chemistry of titanium, develop experimental studies of phase equilibria in simpler and poly-component systems (including gaseous titanium) about which little information has been published so far. To investigate the kinetics of phase transformations, with special emphasis on establishing the nature of metastable phases in titanium alloys. To extend the scope and range of investigations of metallic titanium compounds and of the solid solutions formed on their basis, in order to establish their structure and develop new materials with specific physical properties (heat-resistance, semiconducting characteristics etc). To investigate the means of protecting titanium and its alloys against oxidation under production and service conditions. To develop and recommend for this purpose gaseous, liquid and solid protecting media. To develop methods of chemical etching of titanium and its alloys. The Conference emphasized in particular the necessity of developing measures for reducing gaseous impurities in titanium sponge and semi-finished products. The next conference on titanium and its alloys is planned for March 1963.

Card 2/2

FEDOTOV, S.G.; NARTOVA, T.T.; SINODOVA, Ye.P.

Elastic properties of alloys of the titanium - aluminum system.
Dokl. AN SSSR 146 no.6:1377-1379 0 '62. (MIRA 15:10)

1. Institut metallurgii im. A.A. Baykova. Predstavleno akademikom
G.V. Kurdyumovym.
(Titanium-aluminum alloys)

L 19744-63

ACCESSION NR: AP 3000916

EWP(q)/EWT(m)/BDS

AFFTC/ASD

JD/JG

S/0279/63/000/002/0141/0145

AUTHCRS: Fedotov, S. G. ; Nartova, T. T. ; Sinodova, Ye. P. (Moscow)

X B

TITLE: Elastic properties of Ti-Sn alloys

SOURCE: AN SSSR, Iz. otd. tekhn. nauk. Metallurgiya i gornoye delo, no. 2, 1963, 141-145

TOPIC TAGS: Ti-Sn alloy, elastic properties

ABSTRACT: Elastic properties of alloys containing up to 25% (by weight) of Sn were studied. The elastic constants (Young's modulus, shear modulus, and Poisson ratio) were determined, and the characteristic Debye temperature of the alloys was calculated. It was established that alloys contain three phases that differ sharply in their elastic properties. The introduction of Sn into the alpha-solid Ti solution causes a minor decrease in the elastic constants (with a subsequent small increase as the alloys approach the saturation limit). The transition into the region of the binary phase (alpha + beta) is marked by a sudden decrease in the elasticity moduli. An intensive (almost linear) decrease in the elasticity constants in this region is observed with the increase in gamma-phase content. This continues up to the boundary of the homogeneous gamma-region of solid solutions on the Ti₃Sn

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ACCESSION NR: AP3000916

base. The extremely high values of the elastic properties correspond to the compound Ti_3Sn . Elastic properties of the alloy with 2.5% of Sn decrease with the increase in temperature. The increase in Sn content lowers the rate of this decrease. The higher the Sn content, the higher are the values of the elastic properties of alloys at high temperatures. The elastic properties of a two-phase alloy with 25% of Sn do not vary significantly during heating. The increase in the heat resistance of the alpha-solid Ti solutions with the increase in Sn content is due to the increase in the force of interatomic bonds and in the stability of these bonds as compared to the bonds in pure Ti or in diluted solid solutions. Orig. art. has: 2 figures and 4 formulas.

ASSOCIATION: none

SUBMITTED: 23May62

DATE ACQ: 12Jun63

ENCL: 00

SUB CODE: ML

NO REF SOV: 007

OTHER: 006

Card 2/2

FEDOTOV, S.G.

Dependence of the elastic properties of titanium alloys on their composition and structure. Titan i ego splayv no.10:188-201 '63.

(MIRA 17:1)

L 12711-63

EWP(q)/EWT(m)/BDS

AFFTC/ASD

JD/JG

ACCESSION NR: AP3000297

S/0020/63/150/001/0077/0080

60

AUTHOR: Fedotov, S. G.; Belousov, O. K.

59

TITLE: Elastic properties of titanium-molybdenum, titanium-vanadium, and titanium-niobium alloys

SOURCE: AN SSSR. Doklady, v. 150, no. 1, 1963, 77-80

TOPIC TAGS: modulus of elasticity, modulus of rigidity, "Elastomat" type apparatus, commercial titanium TG-00 alloys, H sub 2, O sub 2, N sub 2, Si, Mo, Nb, V

ABSTRACT: Authors investigate the elasticity constants (modulus of elasticity E and modulus of rigidity G) of titanium alloys in Alpha, Beta and Alpha + Beta solutions by resonance method on "Elastomat" type apparatus (F. Förster, Zeitschrift Metallkunde 29, 109, 1937) at room temperature. Study was made on commercial titanium (TG-00 brand) alloys containing 0.002% H sub 2, 0.02% O sub 2, 0.04% N sub 2 and 0.09% Si. The alloying admixtures had the following purity (in %): 99.9 for Mo, 99.4 for Nb (0.2 Ta), and 99.51 for V (0.3 of O sub 2 and 0.1 of C). Forged test samples were hardened at 900C and tempered at 600C. Authors discovered that Beta phase and an increase of alloying elements lower the elasticity constants. A molybdenum content of 6%, vanadium content of 10% and niobium content of 15 to 17% in alloys hardened at 900C lower E and G. Martensite phase (Omega) in-

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ACCESSION NR: AP3000297

creases E and G, but these are always lower than those in the Alpha phase. A similar character of changes in the elasticity constants was obtained for all three alloys, and a great effect of the metastable phase on the elasticity constants in the Beta phase hardened alloys was found. Authors conclude by stating that it is possible to foresee the concentration of metastable phases in titanium alloys hardened in Beta solution through a measurement of the elasticity constants. Orig. art. has: 1 figure and 2 tables.

ASSOCIATION: Institut metallurgii im. A. A. Baykova (Institute of Metallurgy)

SUBMITTED: 12Dec62

DATE ACQ: 10Jun63

ENCL: 00

SUB CODE: PE, ML

NO REF SOV: 011

OTHER: 006

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ACCESSION NR: AP4039601

S/0126/64/017/005/0732/0736

AUTHOR: Fedotov, S. G.; Belousov, O. K.

TITLE: Elastic constants of titanium-niobium alloys

SOURCE: Fizika metallov i metallovedeniye, v. 17, no. 5, 1964, 732-736

TOPIC TAGS: titanium niobium alloy; alloy elastic constant, alloy Young modulus, shear modulus, alloy density, alloy elasticity, alloy elasticity modulus

ABSTRACT: The Young modulus (E) and shear modulus (G) were determined for titanium-niobium alloys containing up to 60% niobium. The alloys were melted in an arc furnace with a nonconsumable tungsten electrode in an argon atmosphere, annealed at 600-700C for 200-500 hr, air cooled or annealed at 900C, and water quenched. The E of the alloys annealed at 600 or 700C decreased from 11,770 kg/mm² for pure titanium to 10,880 kg/mm² for the alloy with 4 wt % niobium; G decreased correspondingly from 4450 kg/mm² to 4070 kg/mm². The further increase of niobium content up to 50% was accompanied by a linear or almost linear decrease of both moduli to

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ACCESSION NR: AP4039601

7990 kg/mm² for E and to 2700 kg/mm² for G, after which both increased somewhat when niobium content reached 60%. In alloys water-quenched from 900C, E drops sharply to 6760 kg/mm² at a niobium content of 15-17%, increases to 9590 kg/mm² at 30% niobium, drops again to 6920 kg/mm² at 40% niobium, and then increases again (see Fig. 1 of the Enclosure). Such behavior is explained by the formation of metastable phases α' , α'' and ω and an unstable phase β . Curves of the temperature dependence of E, plotted for alloys which had the highest and lowest values of E at room temperature (see Fig. 2), differ greatly from one another. It is concluded that niobium sharply decreases E and G in the region of transformation. Orig. art. has: 2 figures and 1 formula.

ASSOCIATION: Institut metallurgii im. A. A. Baykova AN SSSR (Institute of Metallurgy, AN SSSR)

SUBMITTED: 04Mar63 /

ATD PRESS: 3053

ENCL: 02

SUB CODE: MM, ME

NO REF SOV: 007

OTHER: 004

2/4

Card

FEDOTOV, S.G.; BELOUSOV, O.K.

Elastic properties of multicomponent titanium alloys with molybdenum, vanadium, and niobium. Dokl. AN SSSR 155 no.6:1387-1390 Ap '64.

(MIRA 17:4)

1. Institut metallurgii im. A.A.Baykova. Predstavleno akademikom I.I.Chernyayevym.

L 15198-65 EWT(m)/EWP(w)/EWA(d)/EWP(t)/EWP(b) ASD(m)-3 JD/MLK
ACCESSION NR: AT4046851 S/0000/64/000/000/0253/0257

AUTHOR: Bratenko, V. N., Fedotov, S. G.

TITLE: A study of the elastic characteristics of chromium-manganese steels 6 B

SOURCE: AN SSSR. Nauchnyy sovet po probleme zharoprochnykh splavov. Issledovaniya staley i splavov (Studies on steels and alloys). Moscow, Izd-vo Nauka, 1964, 253-257

TOPIC TAGS: alloy steel, austenitic steel, chromium manganese steel, steel elasticity, steel plastic deformation

ABSTRACT: Iron with 11.1-11.9 wt. % Cr, 18-20.1 wt. % Mn, 0.06-0.08 wt. % C, and 0.017-0.22 wt. % N was the base of alloys with 0.07-0.57 and 2.03% Ti, 0.30-1.05% V, 0.49-1.89, 2.51 and 2.98 Mo, and 1.05-3.71% W used in a study of the effects of these alloying elements on the elastic modulus (E), shear modulus (G), Poisson coefficient and logarithmic damping coefficient of austenitic chromium-manganese steels. Samples were tested after quenching from 1150C in water, stabilizing tempering at 750C for 10 hrs, and prolonged subjection to tensile stresses of 20 kg/mm² at 650C. The dynamic method was used to determine the elastic constants in samples 120 mm long and 8 mm in diameter in

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ACCESSION NR: AT4046851

which transverse, longitudinal and torsional stresses were generated and the natural frequencies of vibrations were determined by a resonance method with an Elastomat device having an accuracy to 1 cps. From a rather complex and nonuniform pattern of results obtained, the conclusions are drawn that: a) in general, alloying leads to a slight increase in the elastic characteristics in the steels investigated; b) the increase in plastic deformation resistance may be attributed essentially to carbide and other aggregations which lead to the strengthening of the lattice of the gamma-solid solution; and c) deformation is a factor distinctly accelerating austenite decomposition, thus changing the elastic properties. Orig. art. has: 2 figures and 2 tables.

ASSOCIATION: none

SUBMITTED: 16Jun64

ENCL: 00

SUB CODE: MEM

NO REF SOV: 004

OTHER: 002

Card 2/2

L 14975-65 EWT(m)/EWP(t)/EWP(b) IJP(c)/ASD(m)-3 JP/MLK
 ACCESSION NR: AT4048090 S/000/64/000/000/0303/0315

AUTHOR: Fedotov, S.G.

TITLE: Metastable phases in titanium alloys and the conditions of their formation

SOURCE: Soveshchaniye po metallurgii metallovedeniya i primeneniya titana i yego
splavov. 5th, Moscow, 1963. Metallovedeniye titana (Metallography of titanium);
trudy* soveshchaniya. Moscow, Izd-vo Nauka, 1964, 308-315

TOPIC TAGS: titanium alloy, titanium alloy alpha phase, titanium alloy beta phase,
 titanium alloy omega phase, alloy phase transformation, titanium alloy crystal lattice,
 metastable phase

ABSTRACT: The physical and mechanical properties of alloys depend to a great extent
 on their structure, although heat treatment and mechanical working may change them.
 For titanium alloys, the basic theories of thermal and thermomechanical working have
 not yet been developed, much less practical methods for their implementation. In the
 present paper, the author reviews some of these questions. After hardening, titanium
 contains several metastable phases in the β field. These are known as the α' , α'' ,
 ω and β phases. The α' phase is a super saturated solid solution of alpha-Ti with a

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ACCESSION NR: AT4048090

hexagonal crystal lattice. The α'' phase differs from the α' phase by a rhombic lattice due to higher super saturation. The ω phase, found only by X-ray analysis, has a hexagonal crystal structure. These three phases are martensitic. The β solid solution has lower hardness, higher plasticity, a lower yield point, and a greater difference between the yield point and the ultimate strength than the other metastable phases. The ω phase, first found by P.D. Frost et al. in 1954, causes brittleness and higher hardness, density and strength, while the elasticity is also increased. The ω phase is formed by tempering of highly alloyed β solid solutions. Yu. A. Bagoryutskiy considers the ω phase to be a metastable low-temperature modification of the β solid solution of the electronic type. The present author feels that the ω phase cannot be of the electronic type since the ω phase is found during tests in alloys of titanium with zirconium where the electron concentration remains constant. He also states that the ω phase is a product of transformation of the β solid solution. The lattice of the ω phase does not depend on the conditions of formation. The process of $\beta \rightarrow \delta$ transformation proceeds at similar martensitic temperatures (300-500C) regardless of the alloying elements. The temperature of formation of the δ phase during tempering of the β phase is 180-500C and is actually the same as the formation temperature during hardening. The ω phase is neither

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microscopic nor electron microscopic, and its crystal structure has not yet been determined. In conclusion, the author states that the β phase is a product of incomplete $\beta \rightarrow \alpha$ transformation. Other metastable phases show varying degrees of completion of $\beta \rightarrow \alpha$ transformation, but further research is needed to determine the processes occurring in metals and alloys. These metastable phases are formed in titanium alloys with transition elements by unlimited dissolution in β -Ti and by low dissolution in α -Ti, which increases as the temperature drops. Besides, high or unlimited dissolution in β -Ti and very low, decreasing dissolution in α -Ti occurs when the temperature drops below the eutectic temperature, while the β solution undergoes eutectic disintegration. Therefore, alloys of both the first type (Ti-Mo, Ti-V, Ti-Nb, Ti-Ta, Ti-Mo-V, Ti-Mo-Nb, Ti-V-Nb, and Ti-Mo-V Nb) and the second type (Ti-Cr, Ti-Fe, Ti-Co, Ti-Mn, Ti-Ni) has been investigated. These results will be published in a later paper. "The first type of alloy was tested together with O.K. Belousov, the second type with Ye. P. Sinodova."

ASSOCIATION: none

SUBMITTED: 15Jul64

ENCL: 00

SUB CODE: MM

NO REF SOV: 020

OTHER: 022

Card 3/3

L 23353-65 EWT(m)/EWP(t)/EWP(b)/EWP(l)
ACCESSION NR: AT4046822

Pad IJP(c) JI/HW/MLK
S/0000/64/000/000/0088/0091

AUTHOR: By*strov, L.N.; Fedotov, S.G.

TITLE: Temperature dependence of the elastic constants of copper-nickel alloys

SOURCE: AN SSSR. Nauchny'y sovet po probleme zharoprochny'kh splavov. Issledovaniya
stal' i splavov (Studies on steels and alloys). Moscow, Izd-vo Nauka, 1964, 88-91

TOPIC TAGS: nickel alloy, copper alloy, elasticity modulus, shear modulus, Poisson
bracket, torsional vibration, damped oscillation

ABSTRACT: The modulus of normal elasticity and the shear modulus of copper-nickel
alloys containing 1, 10, 20 and 30% Ni were measured by a resonance method. The
modulus values decrease with an increase in temperature; no abnormalities in the
moduli were observed. Equations are given for the calculation of both the normal
elasticity and the shear modulus. The temperature dependence of the elasticity modulus
is shown in the coordinates $E - T^{3/2}$; since all the points lie on a straight line it is
possible to extrapolate values for higher temperatures. The dependence of the Poisson
bracket on the composition and temperature of the alloy was also analyzed. It was found
that the Poisson bracket increases slightly with an increase in temperature and does not
depend too strongly on the alloy composition (its change does not exceed $\pm 5\%$). It is

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L 23353-65

ACCESSION NR: AT4046822

therefore possible to use an average value of the Poisson bracket equal to 0.4 for the conversion of the normal elasticity and the shear modulus values. The dependence of the parameters E_0 and β on the alloy composition is discussed. Orig. art. has: 5 figures, 1 table and 6 formulas.

ASSOCIATION: none

SUBMITTED: 16Jun64

ENCL: 00

SUB CODE: MM

NO-REF SOV: 002

OTHER: 001

Card 2/2

L 18600-65 NT(m)/EPP(n)-2/T/EWP(t)/EWP(b) Pu-4 IJP(c)/ASD(f)-2/PAEM(c)
 RAEMO JD/JC
 ACCESSION NR: AP4034038 S/0020/64/155/006/1387/1390

AUTHOR: Fedotov, S. G.; Belousov, O. K.

TITLE: Elastic properties of multicomponent alloys of titanium with molybdenum,
vanadium, and niobium

SOURCE: AN SSSR. Doklady*, v. 155, no. 6, 1964, 1387-1390

TOPIC TAGS: elastic property, modulus of elasticity, modulus of shear, titanium alloy, titanium molybdenum alloy, titanium vanadium alloy, titanium niobium alloy, Ti Mo V system, Ti Mo Nb system, Ti V Nb system, Ti Mo V Nb system, metastable phase, high strength construction alloy

ABSTRACT: The elastic properties (modulus of elasticity and modulus of shear) of the Ti-Mo-V, Ti-Mo-Nb, Ti-V-Nb, and Ti-Mo-V-Nb alloys, in which the alloying elements were used in a 1:1 and 1:1:1 weight% ratio, were determined in a study of the conditions and mechanism of formation of metastable phases in these complex systems which might be useful in producing new high strength construction titanium alloys. This study is a continuation of earlier work (Dan, 150, No. 1, 77 (1963)) relating to binary titanium alloys with Mo, V, and Nb. The experimental data are

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L 18600-65
ACCESSION NR: AP4034038

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... of the inclosure. ...
... then increased slightly ...
... again, and then increased continuously in proportion to the amount ...
... elements. The lower hardness of the as-quenched alloys in which the ...
... concentration of the alloying elements approached the maximum in comparison with ...
... the least alloyed supersaturated solid solutions was attributed to the lower bond ...
... strength in the hardened alloys, the lower hardness of the beta-phase, and the ...
... lower temperature of the martensite transition $\beta \rightarrow \alpha$. A direct relationship ...
... was established between the solubility of the Mo, V, and Nb, added individually ...
... or jointly, in alpha-titanium and the composition of their supersaturated solutions. ...
... The quantitative ratio of these compositions, identical in magnitude, expresses the ...
... ultimate degree of saturation of the hexagonal crystal lattice of titanium by the ...
... alloying elements, which in turn is related to the ultimate elastic stability of ...
... the alpha-titanium crystal lattice. Thus the nature of the change of the elastic

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L 1860D-65
ACCESSION NR: AP4034038

properties of simple or multicomponent titanium alloys with Mo, V, and Nb, in a state of equilibrium or in a quenched state, showed a direct relationship to the chemical interaction of titanium with these alloying elements. Orig. art. has: 1 figure.

ASSOCIATION: Institut metallurgii im. A. A. Baikova (Institute of Metallurgy)

SUBMITTED: 23Dec63

ENCL: 02

SUB CODE: MM, AS

NO REF SOV: 003

OTHER: 001

Card 3/5

L 18600-65
ACCESSION NR: AP4034038

ENCLOSURE: 01

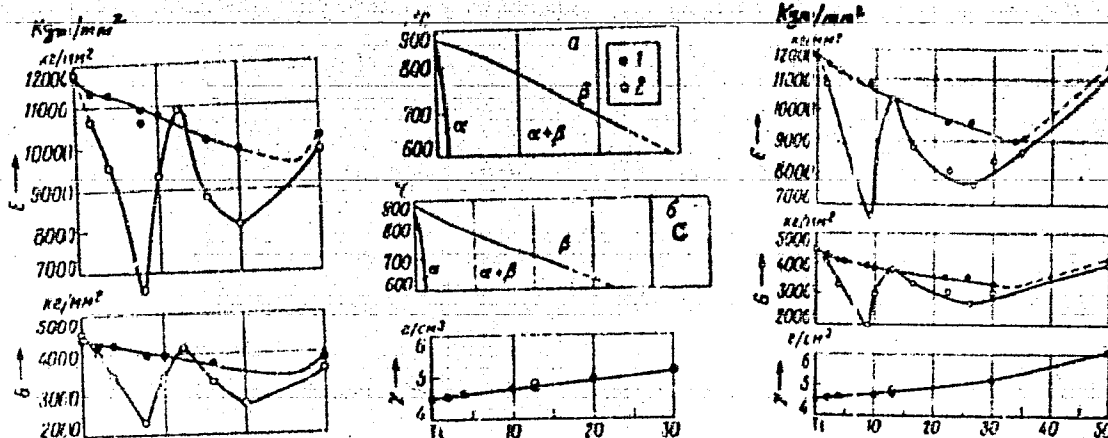


Fig. 1. Concentration relationship of the modulus of normal elasticity (E), modulus of shear (G) of annealed (1) and hardened (2) alloys of the systems: a--Ti-Mo-V; b--Ti-Mo-Nb; c--Ti-V-Nb; d--Ti-Mo-V-Nb

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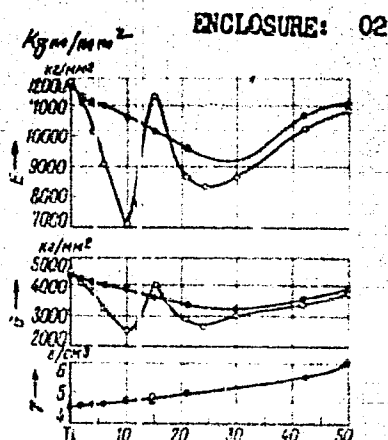
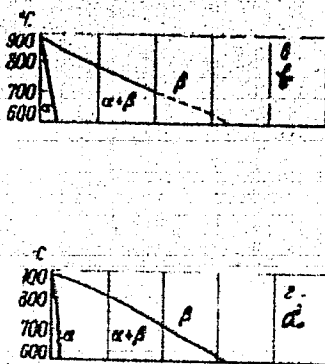
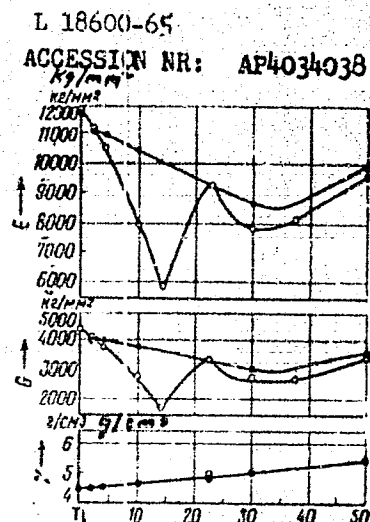


Fig. 1. Concentration relationship of the modulus of normal elasticity (E), modulus of shear (G) of annealed (1) and hardened (2) alloys of the systems: a--Ti-Mo-V; b--Ti-Mo-Nb; c--Ti-V-Nb; d--Ti-Mo-V-Nb

Card 5/5

FEDOTOV, S.G.; BELOUSOV, O.K.

Elastic constants of alloys in the system titanium - niobium.
Fiz. met. i metalloved. 17 no.5:732-736 My '64. (MIRA 17:9)

1. Institut metallurgii imeni Baykova AN SSSR.

L 32215-65 ENT(m)/EPF(n)-2/ENP(t)/EAP(b) Pu-L IJP(c) JD/JG/GS

ACCESSION NR: AT4045997

S/0000 '64/000/000/0207/0240

AUTHOR: Fedotov, S. G.

TITLE: The mechanism and kinetics of the formation of metastable phases in Ti-Alloys

SOURCE: AN SSSR. Institut metallurgii. Issledovaniya metallov v zhidkom i tverdom sostoyaniyakh (Research of metals in liquid and solid states). Moscow, Izd-vo Nauka, 1964, 207-240

TOPIC TAGS: martensite transformation, metastable phase, Ti alloy, crystal lattice, solid solution, elastic property, Young modulus, Poisson ratio

ABSTRACT: Several metastable phases form in alloying Ti with V, Nb, Ta, W, Mo and Re, the least investigated of these phases being the ω -phase which is only visible by X-ray examination. It was found to be a transformation product of a metastable β -solid solution and it invariably coexists with the metastable β -phase. Temper hardening and the type of alloying agents used do not affect its lattice parameters. The $\beta \rightarrow \omega$ -transformation in hardening alloys with a cri-

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ACCESSION NR: AT4045997

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tical concentration occurs at temperatures which are either similar to or approximate M_g (~ 300 to 500 C). The density of the alloys increases as the phase is formed. A theory exists that polymorphous $\beta \rightarrow \alpha$ -transformation is incomplete as a result of the low temperature at which it begins and occurs in two stages, the ω -phase being one of them. In collaboration with O. K. Belousov and Ye. P. Sinodova, the author conducted a comparative study of the metastable phases by investigating the elastic properties of Ti-Mo, Ti-V, Ti-Nb, Ti-Mo-V, Ti-Mo-Nb, Ti-V-Nb, Ti-Mo-V-Nb, Ti-Cr, Ti-Fe, Ti-Mn, Ti-Co, Ti-Ni. The chemical composition of the alloying agents was (weight %): Mo-99.9, V-99.5 with additives Al 0.005; Fe 0.04; Si 0.02; C 0.1; O₂ 0.3; N₂ 0.01; Nb 99.4; with additives Ta 0.2; Si 0.06; Fe 0.05. The author assumes that the crystal lattice attains a limiting state not only as a result of the changes in the composition but also by virtue of other thermodynamic equilibrium factors including pressure and temperature. Within the range of states and until the limiting value is attained, the lattice permits various changes by the different equilibrium factors and any excess of these factors leads to losses in elasticity resistance and the formation of a new more stable state. The maximum of elastic properties is determined by the form-

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L 32215-65

ACCESSION NR: AT4045997

ation of the greatest amount of the ω -phase at $M_g - 300^\circ\text{C}$. Apparently, the formation of the ω -phase occurs within the 500 to 300°C range when atom displacement is greatly inhibited. Below 300°C the solid solution does not undergo $\beta \rightarrow \alpha$ -transformation. Martensite $\beta \rightarrow \alpha$ -transformations are characterized by two stages, the state of the β -solid solution being the initial stage is a result of the formation of the ω -phase. Saturated α -solid solutions of a limiting composition form at the second stage. It follows that the crystalline structure of the solid solution and the physical and mechanical properties of the alloy depend on the degree of deviation from the central interaction between atoms in the bond strength. The possibility of the formation of the ω -phase in the solid solution depends on the possibility of the transformation of the solid solution into the ω -phase. The modulus of rigidity of saturated α -solid solutions depends on the lattice distortions brought about by the atoms of the alloy components. The concurrent increase in the Poisson's ratio in this region of components to its critical value means that this distortion and the decrease in the modulus reflect the degree of deviation from the central interaction between atoms in the bond strength. Orig. art. has: 3 figures and 2 tables.

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L 32215-65

ACCESSION NR: AT4045097

ASSOCIATION: None

SUBMITTED: 18May64

ENCL: 00

SUB CODE: MM

NR REF SOV: 030

OTHER: 026

Card 4/4

L 2663-66 EWT(m)/EWP(w)/T/EWP(t)/EWP(z)/EWP(b) IJP(c) JD/HW/JG/GS

ACCESSION NR: AT5023095

UR/0000/65/000/000/0152/0160

AUTHOR: Pedotov, S. G.; Sinodova, Ye. P.

TITLE: Elastic properties of the hardened alloys of titanium with eutectoid-forming elements -- chromium, manganese, iron, cobalt, and nickel

SOURCE: Problemy bol'shoy metallurgii i fizicheskoy khimii novykh splavov : (Problems of large-scale metallurgy and physical chemistry of new alloys); k 100-letiyu so dnya rozhdeniya akademika M. A. Pavlova, Moscow, Izd-vo Nauka, 1965, 152-160

TOPIC TAGS: elastic modulus, phase diagram, titanium base alloy, chromium containing alloy, solid solution, metal hardening, eutectoid

ABSTRACT: The present work is a continuation of earlier investigations by the authors, with the difference that the factors investigated in this case were: the modulus of normal elasticity, modulus of rigidity, Poisson's ratio, logarithmic attenuation decrement, and Vickers hardness of hardened alloys of the Ti-Cr, Ti-Mn, Ti-Fe, Ti-Co, and Ti-Ni systems. A characteristic feature of alloys of

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L 2663-66

ACCESSION NR: AT5023095

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these systems is the formation of the metastable phases α' , ω and β of a presumably identical nature and structure, during hardening. As in the two previous investigations, (S. G. Padotov, O. K. Belousov, Dokl. AN SSSR, 150, 1, 77, 1963; 155, 6, 1387, 1964), elastic properties of the alloy specimens hardened by quenching from 1000°C were measured by the dynamic method with the aid of an Elastomat device. It was established that the different systems investigated display a common pattern of variation in the specified parameters, which is associated with the similarity of interaction between Ti and Cr, Fe, Mn, and Co. At first all the alloy elements depress the elastic properties to a different degree, and thereupon they cause an abrupt increase in these properties, which corresponds to the formation of the ω -phase. This maximum is again followed by a fall, due to the fixation of the metastable β -solid solutions. The general type and nature of variation in the elastic constants of alloys of the Ti-Cr, Ti-Mn, Ti-Fe, and Ti-Co systems, which represent one type of interaction, display much in common with those of the alloys of the Ti-Mo, ⁷Ti-V, ⁷Ti-Nb, and other systems, which represent another type of interaction. Despite this seeming similarity, there also exist definite differences in elastic properties, which the authors attribute to the different nature of the interaction of Ti with elements of these two groups, since

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ACCESSION NR: AT5023095

the interaction of Ti with Cr, Mn, Fe, Co, and Ni is also characterized by the formation of broad (Mn, Fe, Co, Ni) or unlimited (Cr) ranges of β -solid solutions and extremely limited ranges of α -solid solutions; in alloys of these systems, by contrast with alloys of the systems formed by Ti with Mo, V, and Nb, the β -solid solution undergoes eutectoid decomposition, while the solubility of Cr and other elements of this group in α -Ti also increases with the fall in temperature to eutectoid temperature but, once a certain point is reached, it decreases again. Hence, it is suggested that martensite transformation in alloys with eutectoid-forming elements also takes place in two stages. The first stage of $\beta \rightarrow \alpha$ transformation occurs in the same way as in alloys of the Ti-Mo, Ti-V, and Ti-Nb systems. This is what they have in common. The second stage of the transformation process takes place only in alloys with eutectoid-forming elements; this is what differentiates the compared alloy groups. Here major significance is attached to the temperature of eutectoid transformation. The higher this temperature is, the greater, obviously, the extent to which the self-tempering of primary supersaturated α -solid solutions will occur and the more complete the recovery of elastic properties will be. Conversely, a lower temperature of eutectoid transformation in the system complicates the process of the self-tempering of supersaturated α -solid solutions forming during the hardening and hence contributes to the

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ACCESSION NR: AT5023095

fixation of the more supersaturated α -solid solutions with lower elastic constants. From this standpoint considered, the elastic properties of alloys of the Ti-Cr system directly point to a lower eutectoid temperature than that of the other systems investigated. Orig. art. has: 3 tables.

ASSOCIATION: none

SUBMITTED: 00

ENCL: 00

SUB CODE: SS, ME

NO REF SOV: 008

OTHER: 005

Card 4/4

BAL'SHIN, M.Yu. (Moskva); FEDOTOV, S.G. (Moskva)

Contact and elastic characteristics of powder copper. Izv. AN SSSR.
Met. no.1:165-172 Ja-F '65. (MIRA 18:5)

L 56055-65 EWT(m)/EWP(w)/EPF(n)-2/EWA(d)/T/EWP(t)/EWP(b)/EWA(c)
IJP(c) JD/HW/JG

Pad/Pu-4

ACCESSION NR: AP5010554

UR/0129/65/000/004/0026/0036
669.295.26'24'25'74:621.735.61

AUTHOR: Fedotov, S. G.; Sinodova, Ye. P.

TITLE: Characteristics of the martensite transformation in titanium alloys

SOURCE: Metallovedeniye i termicheskaya obrabotka metallov, no. 4, 1965, 26-36, and insert facing p. 40

TOPIC TAGS: martensite transformation, titanium alloy, alloy elasticity, hardened alloy, Young modulus, shear modulus, alloy phase transformation

ABSTRACT: The elastic properties of hardened alloys of titanium with eutectoid-forming elements were studied; in such alloys, metastable phases of similar structure are formed on hardening. Young's modulus and the shear modulus were determined by the dynamic method with an "Elastomat" instrument. Many similarities were observed in the general aspect of the change (with Ti content) in the elastic properties of alloys of the systems Ti-Cr, Ti-Mn, Ti-Fe, and Ti-Co, representing one type of interaction, and alloys of the systems Ti-Mo, Ti-V, Ti-Nb, etc., representing another type of interaction, but marked differences were seen in the change of properties on the first portion of the curves, which

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L 56055-65
ACCESSION NR: AP5010554

corresponds to the formation of supersaturated α' solid solutions. The martensite transformation occurs in two stages: in the first, the $\beta \rightarrow \alpha$ transformation involves the formation of α' solid solutions of limiting concentration which is proportional to the solubility of the elements in α titanium. The second stage, which consists in the depletion of the primary supersaturated α' solid solutions, begins at the eutectoid temperature and ends at temperatures at which the displacements of atoms under hardening conditions become very difficult (300-400C). This second stage causes a decrease in the content of alloying elements present in the supersaturated α' solid solutions of titanium, and hence to self-tempering, which results in the restoration of Young's modulus and shear modulus and an increase in hardness. Orig. art. has: 3 figures and 1 table.

ASSOCIATION: Institut metallurgii im. A. A. Baykova (Institute of Metallurgy)

SUBMITTED: 00

ENCL: 00

SUB CODE: MM, SS

NO REF SOV: 005

OTHER: 005

Card

2/2

L 7905-66 EWT(m)/T/EWP(t)/EWP(b)/EWA(c) IJP(c) JD

ACC NR: AP5027930

SOURCE CODE: UR/0363/65/001/010/1737/1742

AUTHOR: Fedotov, S. G.

ORG: Institute of Metallurgy im. A. A. Baykov (Institut metallurgii)

TITLE: The temperature variations in the polymorphic transformation of titanium on alloying

SOURCE: AN SSSR. Izvestiya. Neorganicheskiye materialy, v. 1. no. 10, 1965, 1737-1742

TOPIC TAGS: titanium base alloy, martensitic transformation, elastic modulus, shear modulus

ABSTRACT: A direct relationship was established between the change in the elastic constants (normal elasticity modulus E and shear modulus G) and in the temperature of the polymorphic or martensitic $\beta \rightarrow \alpha$ transformation of titanium upon dissolution of other elements (Mo, V, Nb, Ta) in this metal. The rise or drop in the polymorphism temperature of titanium and the solubility are determined by a corresponding change in the elastic stability of the crystalline lattices of α - and β -titanium produced by the dissolved elements. The established relationships in the change of the elastic constants and temperature of the polymorphic and martensitic transformation of titanium on alloying are apparently common to all alloys based on other polymorphous metals. Orig. art. has: 3 figures and 2 tables.

SUB CODE: IC, MM / SUBM DATE: 05Jul65 / ORIG REF: 005 / OTH REF: 004

Card nw
1/1

UDC: 646.821:541.7

FEDOTOV, S.G.

Variation of temperature of the polymorphic transformation of titanium on alloying. Izv.AN SSSR.Neorg.mat. 1 no.10:1737-1742 0 '65. (MIRA 18:12)

1. Institut metallurgii imeni A.A.Baykova, Moskva. Submitted July 5, 1965.

L 35527-56

EWI(m)/EWP(w)/T/EWP(t)/ETI IJF(C) JU/RE/AD/JS

ACC NR: AT6012390

SOURCE CODE: UR/0000/65/000/000/0189/0197

AUTHORS: Fedotov, S. G.; Konstantinov, K. M.; Sinodova, Ye. P. 66
B+1

ORG: none

TITLE: Physical properties of binary alloys of titanium in the tempered state 27

SOURCE: Soveshchaniye po metallokhimii, metallovedeniyu i primeneniyu titana i yego splavov, 6th. Novyye issledovaniya titanovykh splavov (New research on titanium alloys); trudy soveshchaniya. Moscow, Izd-vo Nauka, 1965, 189-197

TOPIC TAGS: ~~metallurgy~~, titanium, titanium alloy, ~~elastic property~~, electric resistance, thermal property, metallurgic research, binary alloy, elasticity, tempering metal hardness

ABSTRACT: The concentration variation of elastic and electrical properties of titanium alloys, which are tempered from the β -region, is established. Two groups of titanium alloys were studied: alloys with molybdenum, [✓]vanadium, [✓]and niobium [✓]and alloys with chromium, [✓]manganese, [✓]iron, [✓]cobalt, [✓]and nickel. [✓]Specimens of these types were subjected to a series of sensitive tests for measuring their elastic properties and electrical resistance. The content of the alloying element played the role of the independent variable. Other observations were made of the variation of the microstructure of the alloys with content and temperature. It was established that the elastic and electrical properties are sensitive to the structuring of tempered 16

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L 36527-66

ACC NR: AT6012390

titanium alloys. The appearance of the ω -phase in the structure is accompanied by a decrease in the resistivity and an increase in the modulus of normal elasticity and the shear modulus. With increasing supersaturation of α and β hard mixtures there is an increase of electrical resistance and a decrease of E and G. In systems with eutectic dissociation of a hard mixture a self-tempering of supersaturated hard mixtures occurs for which the degree of self-tempering is higher with higher eutectic temperature; this phenomenon is reflected in values of the elastic properties. Orig. art. has: 3 figures.

SUB CODE: 11/ SUBM DATE: 02Dec65/ ORIG REF: 013/ OTH REF: 010

Card 2/2/11LP

L 09018-67 EWT(d)/EWT(m)/EWP(w)/EWP(v)/EWP(t)/ETI/EWP(k)/EWP(h)/EWP(l) IJP(c)
ACC NR: AP6027797 JD/HW SOURCE CODE: UR/0126/66/022/001/0137/0138

AUTHOR: Orlov, A. F.; Fedotov, S. G.

ORG: Institute of Metallurgy im. A. A. Baykov (Institut metallurgii)

TITLE: Temperature dependence of the moduli of elasticity and shear of Ni-Cu alloys

SOURCE: Fizika metallov i metallovedeniye, v. 22, no. 1, 1966, 137-138

TOPIC TAGS: nickel base alloy, copper, Young modulus, shear modulus, temperature dependence

ABSTRACT: Despite the large number of studies devoted to the physical properties of Ni-Cu alloys, the pattern of variation in the moduli of elasticity and shear of these alloys as a function of temperature and concentration has so far been inadequately investigated. To fill this gap, the authors investigated the temperature course of these moduli for pure Ni as well as for six Ni-Cu alloys containing 0.3, 7.1, 11.7, 35.8, 64.6, and 78.0% Cu. The measurements were performed by means of an "Elastomat" device through the excitation of transverse, longitudinal and torsional vibrations in annealed cylindrical specimens at from 0 to 800°C. Findings: The moduli of elasticity E and shear G monotonically decrease with increas-

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UDC: 539.292:539.3:536

L 09018-67

ACC NR: AP6027797

ing temperature, except that for pure Ni and alloys with a low Cu content these moduli dip steeply at $<400^{\circ}\text{C}$ (Fig. 1) owing to the fact that ferromagnetism persists at temperatures

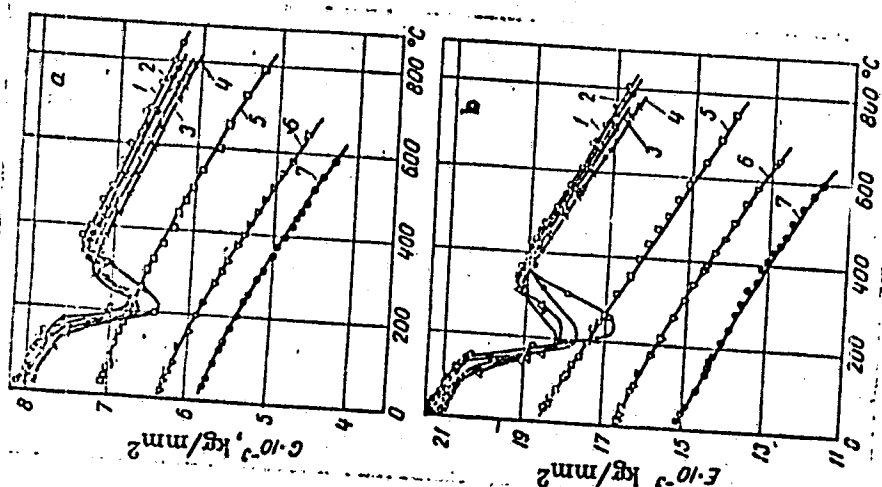


Fig. 1. Temperature dependence of modulus of shear (a) and modulus of elasticity (b) of Ni-Cu alloys:
1 - pure Ni; 2 - Ni + 0.3% Cu; 3 - Ni + 7% Cu; 4 - Ni + 12% Cu; 5 - Ni + 36% Cu; 6 - Ni + 65% Cu; 7 - Ni + 78% Cu

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I. 09018-67

ACC NR: AP6027797

below 400°C in Ni-Cu system alloys containing up to ~30% Cu. For alloys with a high Cu content the change in moduli with temperature is more pronounced. The concentration dependence of the moduli E and G at a constant temperature can be approximated by straight-line curves which indicates that the dependence of E and G on alloy composition (for alloys of the Ni-Cu system) is linear regardless of the concentration. Orig. art. has: 2 figures, 2 formulas.

SUB CODE: 11, 20/ SUBM DATE: 02Nov65/ ORIG REF: 002/ OTH REF: 003

Card 3/3 nst

FEDOTOV, S. M.

"On the Maximum Flow through a Net" (25 March 1960). Abstract of the article: Elias, P., Feinstein, A., Shannon, C. E., A Note on the Maximum Flow Through a Network, Transactions IRE, IT-2, 4, 1959, 117-119.

paper delivered at the Moscow State University in 1959/1960 academic year at the seminar on mathematical problems of cybernetics under the leadership of S. V. Yablonskiy

KARPMAN, M.A.; FEDOTOV, S.Ya.

Reducing permeability and increasing air moisture absorption
in Russian leather. Leg. prom. 15 no.11:21-23 N '55.

(MIRA 9:2)

1.Glavnyy inzhener Omskogo koshevennogo zavoda (for Karpman)
(Tanning)

Fedotov, S. Ya

USSR/Chemical Technology - Chemical Products and Their
Application - Leather. Fur. Gelatin. Tanning Agents.
Technical Proteins.

I-29

Abs Jour : Referat Zhur - Khimiya, No 9, 1957, 33109
Author : Karpman, M.A., Fedotov, S.Ya.
Inst :
Title : Salt Treatment of Dehaired Hides is Effective.
Orig Pub : Legkaya prom-st', 1956, No 5, 38-39

Abstract : A verification was carried out of the salt method of de-
haired hide treatment and of the effect of this method
on surface area yield and raw hide expenditures. Salt
treatment was conducted at a temperature of 22-23°, with
a liquid coefficient of 0.9 and a concentration of salts
of 117-135 g/liter (7 parts NaCl and 3 parts $(\text{NH}_4)_2\text{SO}_4$)
with subsequent chrome treatment using the spent salt
solution at negative basicity of 18-20%. Vegetable tan-
ning and finishing were carried out according to a

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USSR/Chemical Technology - Chemical Products and Their
Application - Leather. Fur. Gelatin. Tanning Agents.
Technical Proteins.

I-29

Abs Jour : Ref Zhur - Khimiya, No 9, 1957, 33109

single procedure. It was found that the salt treatment reduces the duration of the production cycle and simplifies technological control. Organoleptically the finished product is of entirely satisfactory quality, while the chemical and physico-mechanical indices meet the GOST. Surface area of leather is increased by 0.63%, and raw hide expenditure is reduced by 1.16% in comparison with the pickling treatment of dehaired hides. A critique is given of the objections to the salt treatment method, which were set forth in the paper by Sergeyev S.I. (RZhKhim, 1955, 28009), and it is pointed out that the salt treatment can be incorporated in the single procedure.

Card 2/2

FEDOROV, T.F.; KUZ'MA, Yu.B.; GORSHKOVA, L.V.

Phase equilibrium in the ternary system zirconium - molybdenum -
carbon. Porosh. met. 5 no.3:69-74 Mr '65. (MIRA 18:5)

1. Institut metallurgii imeni Baykova AN SSSR, Moskva i L'vovskiy
ordena Lenina gosudarstvennyy universitet imeni Ivana Franko.

~~REDACTED~~ FEDOTOV, T.S.

Experience gained from work with artificial circulation 162

Novye khirurgicheskie apparaty i instrumenty i opyt ikh primeneniye (New SURGICAL Equipment and Instruments and Experience in Their Use) NO. 1, Moscow, 1957 A collection of Papers of the Scientific Research Inst. for Experimental Surgical Equipment and Instruments.

Voronezh Zoo-Veterinary Inst.

PROKOPOVICH, Petr Ivanovich [deceased]; FEDOSOV, M.F.; FEDOTOV, T.T.,
red.; GOR'KOVA, Z.D., tekhn.red.

[Selected articles on bee culture] Izbrannye stat'i po pchelo-
vodstvu. Moskva, Gos.izd-vo sel'khoz.lit-ry, 1960. 311 p.
(Bee culture) (MIRA 13:8)

FEDOTOV, V.

On the White Sea. IUn. nat. no.2:28 F '63. (MIRA 16:11)

SHEVCHENKO, Ye.; ~~FEDOTOV, V.~~

Amateur photographers need guidance. Sov.foto 18 no.10:40
O '58. (MIRA 11:11)

1. Ispolnyayushchiy obyazannosti glavnogo redaktora gazety "Za
peredovuyu tekhniku" (for Shevchenko). 2. Rukovoditel' fotokrushka
pri redaksii mnogotirazhnoy gazety (for Fedotov).

(Photography)

FEDOTOV, V. & MARKETOV, M.

Conservating the quality of fuels and lubricants, No 10,

Tankist, No 12, 1948.

BASHAYEV, K.; IVANOV, K.; POSOKHIN, V.; FEDOTOV, V.

Carry out decisions of the Fourth Congress of the All-Union Society for Assistance to the Army, Air Force, and Navy. Za rul. 16 no.4: 2 of cover-1 Ap '58. (MIRA 13:3)

1. Predsedatel' respublikanskogo komiteta Dobrovol'nogo obshchestva sodeystviya armii, aviatsii i flotu Kazakhskoy SSR (for Bashayev).
2. Predsedatel' Kiyevskogo gorkoma Dobrovol'nogo obshchestva sodeystviya armii, aviatsii i flotu (for Ivanov). 3. Predsedatel' Komsomol'skogo-na-Amure gorodskogo komiteta Dobrovol'nogo obshchestva sodeystviya armii, aviatsii i flotu (for Posokhin). 4. Nachal'nik Zishne-Tagil'skogo avtomotokluba Dobrovol'nogo obshchestva sodeystviya armii, aviatsii i flotu (for Fedotov).

(Automobiles--Societies, etc.)

(Motorcycles--Societies, etc.)

TUV, I., kand.tekhn.nauk; FEDOTOV, V., inzh.

Simplified method of determining the calorific value of fuel oil.
Rech. transp. 20 no. 3:28-29 Mr '61. (MIRA 14:5)
(Petroleum as fuel) (Calorimetry)

FEDOTOV, V.

Let's be more demanding as regards quality. Sov. torg. 35 no.2:45-
46 P '61. (MIRA 14:3)

(Food specifications)

FEDOTOV, V., mayor

Helicopter pilots. Kryl.rod. 12 no.9:19 S '61. (MIRA 14:9)
(Helicopters...Piloting)

PEDOTOV, V.

Help came from mechanisms. Mest.prom.1 khud.promys. 3 no.4:
26-27 Ap '62. (MIRA 15:5)

1. Glavnyy inzh. zavoda po remontu chasov "Lenremchas", Leningrad.
(Clocks and watches--Repairing)

FEDOTOV, V.

Sunglasses. Mest.prom.i khad. promys. 3 no.1:14 Jg '63. (MIRA 16:2)

1. Glavnyy inzh. savoda "Lenremchas", Leningrad.
(Glass, Optical)

FEDOTOV, V., podpolkovnik

Commander's flight style. Av. i kosm. no.2:23-25, 28 F '66.
(MIRA 19:1)

KHANIN, A.I., inzh.; PEDOTOV, V.A., inzh.

Equipment for studying radio relay lines. Avtom., telem. i svias'
6 no.10:12-13 0 '62. (MIRA 16:5)
(Radio relay systems)

FEDOTOV, V.A.; GOLOVAN', A.Ya.

Beveling sheet glass with diamond disks. Stek. i ker. 19 no.2:
18-19 F '62. (MIRA 15:3)
(Glass cutting) (Diamonds, Industrial)

KALIBERDA, V.M., kand. sel'skokhoz. nauk; SULIMOVSKIY, I.G., kand. sel'skokhoz. nauk; BUKHAN'KO, Ye.P.; LOGVINENKO, V.A., agronom; KOVALENKO, A.P.; PODGORNIY, P.I., prof. zasluzhennyy deyatel' nauki Ukrainskoy SSR; FEDOTOV, V.A., aspirant; KURBATOV, I.D., agronom; KOZEYEV, V.I.; SHCHETININ, A.I.; KORCHAGIN, V.A., kand. sel'skokhoz. nauk; SOGURENKO, V.P.; KOSTROV, K.A., kand. sel'skokhoz. nauk; DULYA, F.M.; SHERSTNEV, N.F., aspirant

Crops preceding winter crops in various zones. Zemledelie 27 no.7:
26-45 J1 '65. (MIRA 18:7)

1. Ukrainskaya sel'skokhozyaystvennaya akademiya (for Kaliberda).
2. Odesskiy sel'skokhozyaystvennyy institut (for Sulimovskiy).
3. Odesskaya oblastnaya sel'skokhozyaystvennaya opytnaya stantsiya (for Bukhan'ko). 4. Kolkhoz imeni Kirova, Mar'inskogo rayona Donetskoy oblasti (for Logvinenko). 5. Donetskaya oblastnaya sel'skokhozyaystvennaya opytnaya stantsiya (for Kovalenko). 6. Voronezhskiy sel'skokhozyaystvennyy institut (for Fedotov). 7. Alekseyevskoye rayonnoye proizvodstvennoye upravleniye sel'skogo khozyaystva, Belgorodskoy oblasti (for Kurbatov). 8. Bezenchukskaya sel'skokhozyaystvennaya opytnaya stantsiya (for Korchagin). 9. Direktor Bykovskoy opytной stantsii bakhchevodstva (for Sogurenko). 10. Mordovskaya sel'skokhozyaystvennaya opytnaya stantsiya (for Kostrov). 11. Direktor sovkhoza "Khleborobnyy", Smolenskogo rayona, Altayskogo kraya (for Dulya). 12. Altayskiy sel'skokhozyaystvennyy institut (for Sherstnev).

FEDOTOV, V. A.

USSR/Miscellaneous - Industrial processes

Card 1/1 : Pub. 104 - 8/9

Authors : Fedotov, V. A.

Title : Automatization of abrasive and crocus suspension feeding

Periodical : Stek. 1 ker. 8, 29-31, Aug 1954

Abstract : The automatization of the feeding of abrasive and crocus suspensions, introduced in several glass manufacturing plants of the USSR, is described. The introduction of the new mechanized feeding system brought considerable improvement to the working conditions. Table; graphs; drawing.

Institution :

Submitted :

FEDOTOV, V. A.

✓ Drilling glass. V. A. Fedotov (*Glass & Ceramics, Moscow, 1953, 10, No. 11, 18; GLASS-TIME, 1953, 28, 308*).—A conical drill bit fed with abrasive grains ultimately detaches a conical piece from the under surface of the sheet when the breakthrough occurs. The diameter and thickness of this piece increases with the cone angle of the bit, very rapidly as the angle increases from 90 to 100°. The greatest rate of penetration is given by a drill angle of 60° but an angle of 45° is recommended because the slight sacrifice of cutting rate is more than offset by the smaller size of the piece detached. Kerosene gives 3–5 times the cutting rate given by water.
J. A. SUGDEN.

AUTHOR:

Fedotov, V. A., and Andrusenko, YA. I.

TITLE:

A Perfected Grinder for a Two Side Glass Grinding (Usovershenstvovanny shlifoval'nik dlya dvustoronney shlifovki stekla)

PERIODICAL:

Steklo i Keramika, 1957, Vol. 14, No. 1, pp. 7-10 (U.S.S.R.)

ABSTRACT:

A series of tests were conducted on various type grinders at the Moscow glass manufacturing plant, to determine the efficiency, cost and characteristics of a simultaneous grinding of both (the upper and the lower) sides of a glass pane. For this purpose, a test conveyor consisting of the upper and the lower grinder was selected. A vertically drawn pane glass 2000 x 730 x 6 mm. in size was ground at a feed of 43 m/hr., and the rotation of grinding wheels at 110 r. p. m. No. 320 electrocorundum was used for the above-mentioned test. The efficiency of grinders was determined upon the rate of grinding of the bottom part of glass, according to formula: $K_u = \frac{H}{B} \cdot 100\%$

where the K_u = coefficient of the relative rate of grinding of the bottom part of the glass.

H = number of glass panes fully ground at the bottom

B = number of glass panes fully ground at the top

Card 1/2

FEDOTOV, V.

Watchmaking on conveyers. Mest.prom.1 khud.promys.2 no.3:36-37
Mr '61. (MIRA 14:4)

1. Glavnyy inzhener fabriki No. 1 po remontu chasov, Leningrad.
(Leningrad--Clockmaking and watchmaking)
(Assembly-line methods)

STUPAK, B.F., inzh.; FEDOTOV, V.A., inzh.

Conference on the use of hydraulic transmissions. Sudostroenie
27 no.11:78-79 N '61. (MIRA 15:1)
(Oil hydraulic machinery—Congresses)

FEDOTOV, V.A.; ZASLAVSKIY, M.Z.; LOPUKHIN, V.I.

Machine tools manufactured at the Ryazan Machine-Tool Plant.
Biul.tekh.-ekon.inform.Gos.nauch.-issl.inst.nauch.i tekhn.inform.
no.5:47-49 '62. (MIRA 15:7)
(Ryazan--Machine-tool industry)

ACC NR: AR6022706

SOURCE CODE: UR/0299/66/000/002/R023/R023

AUTHOR: Mal'tsev, N. A.; Miftakhutdinova, F. G.; Fedotov, V. D. 36
B

TITLE: Nature of the state of water in live plant tissues determined by a nuclear magnetic resonance pulse method

SOURCE: Ref. zh. Biologiya, Part I, Abs. 2R155

REF SOURCE: Uch. zap. Kazansk. un-t, v. 124, no. 7, 1965, 20-28

TOPIC TAGS: plant physiology, water, ~~cell physiology~~, nuclear magnetic resonance, spin lattice relaxation, spin resonance, PLANT MORPHOLOGY

ABSTRACT: It has been demonstrated that the spin echo technique is adequate for investigating the state of water in plant tissues. Spin-spin and spin lattice relaxation time and also the self-diffusion coefficient have been measured by this method in plant matter. On the basis of the results it appears that the tissue water is surrounded by a field of molecular and supermolecular forces determined by the cell structures; this denies the existence of free water in a plant cell. On the basis of the self-diffusion coefficient values found for tissue water, it is concluded that the coefficient is determined first of all by the type of tissue, and not by the absolute moisture content. A. Zamyatnin. [Translation of abstract].

Card 1/1 SUB CODE: 06, 18

UDC: 577.3

DYUDIN, A.F.; SHLYKOV, M.M.; ZINKIN, F.I., progruporg, rezchik, udarnik
kommunisticheskogo truda; GORYACHEV, V.M., slesar', profgruporg;
FEDOTOV, V.F., frezerovshchik, ohlen brigady kommunisticheskogo
truda.

Surround the corn growers with care and attention. Sov.profsoizy 17
no.7:24 Ap '61. (MIRA 14:3)

1. Predsedatel' zavkoma Penzenskogo metiznogo zavoda (for Dyudin).
2. Zamestitel' predsedatelya proizvodstvenno-massovoy komissii
zavkoma Penzenskogo metiznogo zavoda (for Shlykov).
(Penza Province—Corn (Maize))
(Socialist competition)
(Penza—Metalwork)

KUMSIYEV, Shalva Alekseyevich, prof., doktor veter. nauk; SOKOLOVA,
G.S., red.; FEDOTOV. V.G., red.; SAYTANIDI, L.D., tekhn.
red.

[Diagnosis and treatment of diseases of the digestive organs
in animals] O diagnostike i terapii zhivotnykh s zabolevani-
ami organov pishchevarenia. Moskva, Izd-vo M-va sel'skogo
khoziaistva RSFSR, 1962. 95 p. (MIRA 16:3)

(Digestive organs—Diseases)
(Veterinary medicine)

TSAREV, Sergey Georgiyevich; FEDOTOV, V.G., red.; SAYTANIDI, L.D.,
tekhn. red.

[Use of drugs in veterinary medicine] Primenenie lekarstven-
nykh sredstv v veterinarii. Moskva, Izd-vo MEKh RSFSR, 1963.
233 p. (MIRA 16:7)
(Veterinary materia medica and pharmacy)

BEGUCHEV, A.P., kand. sel'khoz. nauk; TYUPICH, M.M., kand. biol.
nauk; KONDIYREV, V.Ye., kand. sel'khoz. nauk; AZAROV, G.S.;
FEDOTOV, V.G., red.; SAYTANIDI, L.D., tekhn. red.

[Modern methods in reproducing cattle stock] Poredovoi opyt
vosproizvodstva stada krupnogo rogatogo skota. Moskva, Izd-
vo M-va sel'.khoz.RSFSR, 1963. 114 p. (MIR 16:6)
(Cattle breeding)

LEPIKHIN, L.A., inzh.; Primali uchastiye: STEFANOVICH, M.A., doktor
tekhn.nauk; BABARYKIN, N.N., kand.tekhn.nauk; NEYISOV, A.G.,
kand.tekhn.nauk; SHPARBER, L.Ya., inzh.; BOGDANOV, V.V., inzh.;
ZHARKOV, P.N., master pechi; PANIN, O.G., master pechi; FEDOTOV,
V.G., master pechi; FEOFANOV, N.M., master pechi; SAGAYDAK, I.I.,
inzh., rukovoditel'raboty

Evaluating the effect of various methods of charging a blast
furnace on the state of the gas flow in its upper part. Stal'
23 no. 3:198-204 Mr '64. (MIRA 17:5)

1. Magnitogorskiy metallurgicheskiy kombinat (for Lepikhin).

ANDREYEV, V.V.; FEDOTOV, V.G., veter. vrach; FEFERMAN, A.Ye.,
red.

[Enriching feeds with chemical products] Obogashchenie
kormov khimicheskimi produktami. Moskva, Rossel'khoziz-
dat, 1964. 54 p. (MIRA 17:8)

1. Glavnyy zootekhnik po kormoispol'zovaniyu Ministerstva
proizvodstva i zagotovok sel'skokhozyaystvennykh produktov
RSFSR (for Andreyev).

TROFIMOV, Vladimir Ivanovich, kand. tekhn. nauk; BELYANCHIKOV,
Nikolay Nikolayevich, kand. tekhn. nauk; FEDOTOV, V.G., red.

[Mechanization of labor consuming processes on livestock
farms] Mekhanizatsiia trudoemkikh protsessov na zhivotno-
vodcheskikh fermakh. Moskva, Rossel'khozizdat, 1964. 304 p.
(MIRA 18:12)

KORZHEVENKO, G.N., kand. veter. nauk; IVANOVTSSEV, P.V., kand.
veter. nauk; FEDOTOV, V.G., red.; RIVELIS, Ye.M., red.

[Clinical aspects, pathogenesis, treatment, and veteri-
nary hygiene expertise in burns of farm animals] Klinika,
patogenez, lechenie i veterinarno-sanitarnaya ekspertiza
pri ozhogakh sel'skokhoziaistvennykh zhivotnykh. Mo-
skva, Rossel'khozizdat, 1965. 67 p. (MIRA 18:9)

FEDOTOV, V.I.

Drying of viscose cord fiber on the FN-272 machine. Khim.volok.
no.5:43-45 '59. (MIRA 13:4)

1. Kalininskiy filial Vsesoyuznogo nauchno-issledovatel'skogo
instituta iskusstvennogo volokna (VNIIV).
(Rayon)

TARASENKOV, V.P., kandidat tekhnicheskikh nauk, dotsent; ~~FEDOTOV, V.I.~~
inzhener-polkovnik, redaktor; MYASHNIKOVA, T.F., tekhnicheskii
redaktor.

[Cooling of engines (automobile, tractor, tank)] Okhlazhdenie
dvigatelei (avtomobil'nykh, traktornykh, tankovykh.) Moskva,
Voen.isd-vo Ministerstva obor. SSSR, 1955. 83 p. (MLRA 8:12)
(Gas and oil engines--Cooling)

KUROV, Boris Alekseyevich; ~~FEDOTOV~~, V.I., redakter, inzhener-pelkevník;
SOLOMONIK, R.L., tekhnicheskij redakter.

[How a diesel engine is built and how it works] Kak ustroen i rabetaet
dizel'. Moskva, Voen. izd-vo Ministerstva obr. SSSR, 1955. 143 p.
(Diesel engines) (MLRA 9:5)

Fedotov, V.I.

TARASHNIKOV, Vladimir Petrovich, kandidat tekhnicheskikh nauk, dotsent;
FEDOTOV, V.I., inzhener-polkovnik, redaktor; LEVINSKAYA, N.Z.,
tekhnicheskiiy redaktor.

[Lubrication of engines] Smazka dvigatelei. Moskva, Voen. izd-vo
Ministerstva obor. SSSR, 1956. 101 p. (MLBA 9:5)
(Engines--Lubrication)

FEDOTOV, V. I.

AID P - 5230

Subject : USSR/Aeronautics - education

Card 1/1 Pub. 135 - 16/26

Author : Fedotov, V. I.

Title : Master of swift attacks

Periodical : Vest. vozd. flota, 11, 70, N 1956

Abstract : A short story about how an outstanding pilot, Capt. Zaytsev, carries out interception of aerial targets at night. One photo.

Institution : None

Submitted : No date

FEROTOV, V. I.

Composition for filling dents in autotoldu bodies.
G.S. PETROV, G.S. BRODSKIY, V.A. SVETLYY KOV, I.O.
RADCHIK, V.L. ALIBANOVA, V.I. FEROTOV, AND I.M.
RYABININ. U.S.S.R. 105656 May 25, 1957. A powd.
mixt. of poly-(vinyl butyral) Ph OR-FCW resin
and hexamethylenetetramine is used as filler
for smoothing out uneven spots in autotoldu
bodies as replacement Pb Sn alloys.

M. Housh